

11/30/98



JCS25 U.S. PTO

UTILITY PATENT APPLICATION TRANSMITTAL

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| Address to: Box PATENT APPLICATION Assistant Commissioner for Patents Washington, DC 20231 | Attorney Docket No. | 1569/1570 (USW 0471 PUS) |
| | Inventor(s) or Application Identifier: Curtis L. Ashton Bruce A. Phillips Jimmy G. Godby Richard H. Fink Robert C. Ferry | |

JCS40 U.S. PTO
09/200631

11/30/98

1. This application entitled FIBER TO THE CURB AND FIBER TO THE NEIGHBORHOOD POWER ARCHITECTURE is:

- a. ☒ A new application under 37 C.F.R. §1.53(b).
- b. ☐ A ☐ continuation ☐ divisional or ☐ continuation-in-part application under 37 C.F.R. § 1.53(b) of prior application Serial No. / filed on , entitled .

Application elements and other attached papers:

2. ☒ Specification (incl. Claims and Abstract) [Total Pages 16]
3. ☒ Drawings (☐ informal ☒ formal) [Total Sheets 7]
4. ☒ Oath or Declaration
- a. ☒ Newly-executed
- b. ☐ Copy from a prior application (37 C.F.R. § 1.63(d))
5. ☐ Incorporation By Reference: The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Item 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.
6. ☐ This application is filed by fewer than all the inventors named in the prior application, 37 C.F.R. § 1.53(d)(4).
- a. ☐ **DELETE** the following inventor(s) named in the prior nonprovisional application:

- b. ☐ The inventor(s) to be deleted are set forth on a separate sheet attached hereto.

CERTIFICATION UNDER 37 C.F.R. § 1.10

I hereby certify that this UTILITY PATENT APPLICATION TRANSMITTAL and the documents referred to as attached therein are being deposited on the below date with the United States Postal Service in an envelope as "Express Mail Post Office to Addressee" addressed to: Box Patent Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

Express
Mail Label No. EL187883097US

Date of Deposit: November 30, 1998

Denise Sinnhuber
(Type or print name of person mailing paper)

Denise Sinnhuber
(Signature of person mailing paper)

7. Preliminary Amendment:

- a. ☐ A Preliminary Amendment is attached.
- b. ☐ Cancel in this application original claims _____ of the prior application before calculating the filing fee.
- c. ☐ Please amend the specification by inserting before the first line the sentence:
 "This is a
 ____ continuation
 ____ divisional
 of copending application(s)
 ____ Serial number ____ / _____ filed on _____."
- d. ☐ A Petition to Suspend Prosecution For The Time Necessary to File An Amendment (New Application Filed Concurrently) is attached.

8. Small entity status:

- a. ☐ A small entity statement is attached.
- b. ☐ A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
- c. ☐ Is no longer desired.

9. Fee Calculation:

| FOR | NUMBER FILED | NUMBER EXTRA | RATE | CALCULATIONS |
|---|--------------|--------------|------------------------------------|--------------|
| TOTAL CLAIMS (37 C.F.R. § 1.16(c)) | 14 -20 = | 0 | X 18.00 | 0 |
| INDEPENDENT CLAIMS (37 C.F.R. § 1.16(b)) | 2 -3 = | 0 | X 78.00 | 0 |
| MULTIPLE DEPENDENT CLAIMS (if applicable) (37 C.F.R. § 1.16(d)) | | | 260.00 | |
| | | | BASIC FEE (37 C.F.R. § 1.16(a)) | 760.00 |
| Total of above Calculations = | | | | 760.00 |
| Reduction by 50% for filing by small entity (Note 37 C.F.R. §§ 1.9, 1.27, 1.28) | | | | |
| Assignment Recordal Fee | | | 40.00 | 40.00 |
| TOTAL = | | | | 800.00 |

10. ☒ A check in the amount of \$_____ is enclosed.
11. ☒ The Commissioner is hereby authorized to credit overpayments or charge the following fees (or any deficiency therein) to Deposit Account No. 21-0456 :
- a. ☒ Fees required under 37 C.F.R. § 1.16.
- b. ☒ Fees required under 37 C.F.R. § 1.17.

09200631 113098

12. Maintenance of Copendency of Prior Application

☐ A request for extension of time and the appropriate fee have been filed in the pending **prior** application (or are being filed in the prior application concurrently herewith) to extend the period for response until _____.

13. ☐ An Information Disclosure Statement (IDS) is attached, along with the following indicated attachments thereto:

a. ☐ Form PTO/SB/08 (_____ sheet(s))

b. ☐ Copies of references cited

14. ☐ Certified copy of priority document(s)

15. ☒ Return Receipt Postcard

16. ☐ Other: _____

17. ☒ An Assignment of the invention to US West, Inc.

a. ☒ is attached.

b. ☐ was recorded on _____ at Reel _____, Frame _____.

18. The power of attorney in the prior application is to:

Name of Attorney of Record Reg. No.

☐ The power appears in the original papers in the prior application.

☐ The power does not appear in the original papers, but was filed on _____.

☐ A new power has been executed and is attached.

19. Correspondence Address: Please address all future communications to:

Peter J. Kinsella,
US West, Inc.
1801 California Street, Suite 5100
Denver, Colorado 80202
Telephone: 303-672-2737; Fax: 303-308-9456

Respectfully submitted,



Date November 30, 1998

Name: Paul M. Schwartz
Registration No.: 33,278

☒ Attorney or agent of record
☐ Filed under Rule 34(a)

FIBER TO THE CURB AND FIBER TO THE NEIGHBORHOOD POWER ARCHITECTURE

TECHNICAL FIELD

5 The present invention relates to a powering architecture for energizing a fiber optic communication network and customer telephones with an AC power feed under normal operating conditions and DC backup power when the AC power is not available.

BACKGROUND ART

10 With increasing customer demand for information to be supplied to homes and businesses, telephone communication companies are being pushed to upgrade their communication network infrastructures. In order to supply more information in the form of video, audio and telephony at higher rates, higher bandwidth communication networks are required. Conventional telephone
15 communication network infrastructures utilize fiber optics and twisted copper pair wire to send communication data to a customer. Fiber optic cable supports a high bandwidth while, twisted copper wire supports relatively low bandwidth over long distances. In operation, the fiber optic cable portion of the communications network transmits digital light bits to an optical network unit (ONU). The optical network
20 unit converts the digital light bits to an analog signal which is received by a conventional customer telephone.

 Generally, customers who are within two to three miles of a telephone company's central office are fed communication data solely using twisted copper pair. The twisted copper pair carries the phone signals as well as a -48 volts DC
25 power to operate and ring the phones. Large cables (thousands of pairs), are routed through the telephone central office switch and branch out to various manholes, poles, and cross-connect points to customer locations. For customers who are further away, a digital loop carrier (DLC) cabinet, hut, or buried vault is placed in

an area and reaches up to a two-mile radius. High speed copper lines (T1, DS1, etc.) or fiber cable feed digital bits from the telephone central office to the DLC. Similar to the ONU, the DLC converts the digital signal to an analog waveform required to operate the telephones. A copper drop (twisted copper pairs) relays the analog signals to a customer's home over a radius of two to three miles around the DLC site. The DLC cabinet contains its own batteries, power rectifiers, converters, and a connection for a portable generator. Additionally, the DLC cabinet is connected to an AC power feed from the local power company. For a business or residential customer requiring higher speed data than the standard telephony service, high speed copper or fiber data circuits are routed from the DLC or the CO to the customer location.

The twisted copper cable will not support high bandwidths over a great distance. In order to achieve high bandwidths at a customer location, the fiber optic loop must be brought closer to the customer so that the copper drop is a sufficiently short distance and will be capable of supporting high data transfer rates. One major problem with bringing fiber cable within a short distance of a customer location is the added burden of maintaining the multitude of optical network units (ONUs) which will be required and will typically only serve between twelve to ninety-six customers. Conventional telephone networks utilizing DLCs do not have this problem because there are far fewer DLCs given their capability of serving approximately four hundred to two thousand customers each. Each ONU will require power to make the digital to analog conversion to run the telephones and provide lifeline telephony. Lifeline telephony is required of all telephone communication networks. Lifeline telephony means that the customer telephones must remain energized and operational during an AC power interruption and outage.

As such, a need exists for a system and method for powering a fiber optic communication network which brings fiber within a short distance of a customer location. The fiber optic communication network power architecture must be capable of supporting lifeline telephony and operate the multitude of optical network units in a cost effective and maintainable manner.

DISCLOSURE OF INVENTION

Accordingly, it is an object of the present invention to provide a system and method for reliably powering a fiber optic communication network with
5 AC power under normal operating conditions and DC backup power when the AC power is interrupted, thus providing lifeline telephony service.

It is another object of the present invention to provide a system and method for powering a fiber optic communication network which reduces maintenance costs by providing a limited number of centralized remote power
10 sources.

In accordance with these and other objects, the present invention provides a system and method of powering a fiber optic communication network which transmits communication data between a telephone company central office and a user device. The user device may be a conventional telephone, television,
15 computer or any combination of these devices. The system for powering the fiber optic communication network includes a digital subscriber line access multiplexer (DSLAM) for converting the communication data from an optical state to an electrical state, a fiber optic communication medium (fiber multiplexer) configured to transfer the communication data between the telephone company's central office
20 and the DSLAM. The system further includes a power source configured to supply an electrical supply voltage to power the digital subscriber line access multiplexer, the power source having an AC power feed for providing power to the digital subscriber line access multiplexer, and a DC power feed for providing power to the digital subscriber line access multiplexer when the AC power feed is not supplying
25 power to the digital subscriber line access multiplexer. Further still, an electrical conducting medium configured to conduct the electrical supply voltage and the communication data from the digital subscriber line access multiplexer to a network interface device in electrical communication with the remote user device is provided.

The above objects and other objects, features and advantages of the present invention are readily apparent from the detailed description of the best mode for carrying out the invention when taken in connection with the accompanying drawings.

5

BRIEF DESCRIPTION OF DRAWINGS

FIGURE 1 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the curb configuration where the optical network unit is less than nine thousand feet from the central office, in accordance with the present invention.

10

FIGURE 2 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the curb configuration where the optical network unit is greater than nine thousand feet from the central office, in accordance with the present invention.

15

FIGURE 3 is a detailed block diagram of a remote power source which powers the optical network unit, where the optical network unit is greater than nine thousand feet from the central office, in accordance with the present invention.

20

FIGURE 4 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the neighborhood configuration where the optical network unit includes a DSLAM and a SAI and is greater than 9,000 feet from the central office, in accordance with the present invention.

25

FIGURE 5 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the neighborhood configuration where the optical network unit includes a DSLAM and a SAI which are greater than nine thousand feet from the central office but less than six thousand feet from the optical network unit, in accordance with the present invention.

FIGURE 6 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the neighborhood configuration where a customer is less than four thousand feet from the central office, in accordance with the present invention.

5 FIGURE 7 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the neighborhood configuration where the ONU includes a DSLAM and a SAI and is less than six thousand feet from the central office and less than four thousand feet from the customer, in accordance with the present invention.

10 FIGURE 8 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the neighborhood configuration where the optical network unit is a DSLAM which is collocated with a DLC, where the DLC and DSLAM are less than four thousand feet from the customer, in accordance with the present invention.

15 FIGURE 9 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the neighborhood configuration where the optical network unit contains a DSLAM and an SAI and where the network unit is less than six thousand feet from the DLC and less than four thousand feet from the customer, in accordance with the present invention.

20 FIGURE 10 is a block diagram of a powering architecture for energizing a fiber optic communication network in a fiber to the neighborhood configuration wherein the optical network unit comprises a DSLAM and a SAI and is greater than six thousand feet from the DLC and less than four thousand from the customer, in accordance with the present invention.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to Figure 1, exemplary embodiments of an electrical power architecture for a fiber optic communication network is shown incorporating lifeline telephony powering of customer telephones, according to the present invention. Network elements identical to those described in connection with Figure 1 have been denoted with like reference numerals in Figures 2 through 10. A fiber optic cable 34 is placed between a telephone company central office 20 and an optical network unit (ONU) 22. The fiber optic cable 34 carries communication data in the form of light bits to the optical network unit 22. The optical network unit 22 converts the communication data from a digital light bit state to a digital electrical bit state for communication along the copper drop 38. The copper drop 38 is electrically connected to a network interface device (NID) 24 which is attached to a customer location 26 and receives the communication data. The customer location 26 generally contains a television 28, a telephone 30, and a computer 32 which are in electrical communication with the NID 24 and receive the communication data. The television 28 receives video and audio communication data. The television 28 may include a built-in receiver device or a set-top receiver device which receives digital communication data from the NID 24 and converts the communication data to a format which can be displayed on the television screen. The telephone 30 receives audio communication data and the computer 32 may receive audio as well as video communication data from the NID 24.

In accordance with the present invention when the ONU 22 is less than nine thousand feet from the central office 20, a twisted copper cable 36 is trenched with the fiber optic cable 34 to power the optical network unit 22. The twisted copper cable 36 powers the ONU 22 with a supply voltage of minus 130 VDC. The supply voltage is higher than the minus 48 VDC, required to power the telephones, to compensate for transmission losses. The copper drop 38 is a twisted copper pair cable with a length of less than 750 feet. This communication network configuration is referred to as fiber to the curb as it locates fiber optic cable within a short distance from a customer location 26. A copper drop 38 of less than 750 feet provides a customer with 52 megabits per second of bandwidth. Providing a

customer with higher bandwidths allows the customer to receive a greater amount of communication data. The upstream bandwidth in this configuration is approximately 19 megabits per second. The upstream bandwidth is the rate at which a customer can send communication data back through to the central office 20.

5 In operation the present invention ensures lifeline telephony when an AC power outage occurs. The twisted copper pair cable 36 carries DC electrical power from a power source (not shown) in the central office 20 to the optical network unit 22, therefore the ONU 22 does not require batteries and converters and rectifiers. In this configuration the optical network unit 22 requires little
10 maintenance. The converters, rectifiers, current limiters, and batteries are located in the central office and may be easily maintained. When a power outage occurs, power from the batteries is carried over the twisted copper cable 36 to the optical network unit 22 to ensure that the optical network unit is operational during the AC power outage. The optical network unit converts and transmits the power carried on
15 the twisted copper cable 36 to the copper drop cable 38, which in turn carries the supply voltage to keep alive the telephones 30. The powering architecture just described ensures lifeline telephony to the customer location 26.

 In an alternative embodiment, a fiber to the curb power architecture where the optical network unit 22 is greater than nine thousand feet from the central
20 office 20 is illustrated in Figure 2. The components of the fiber to the curb power architecture 40 of Figure 1 are the same as the fiber to the curb power architecture 50 of Figure 2, with the addition of a remote power source (RPS) 52. The RPS 52 is used to power the optical network unit 22 and is itself powered by conventional AC power feed 21, originating from a local power company. Additionally, RPS 52
25 contains batteries which are capable of powering the optical network unit 22 during a power outage. The ONU 22 in turn powers customer telephones 30 ensuring lifeline telephony during power outages. The RPS 52 is located within nine thousand feet of the optical network unit 22. The RPS 52 feeds power to several ONUs centralizing power supplied at the RPS rather than the ONUs. This powering
30 scheme reduces the number of power sites the telephone communication company has to maintain.

Referring now to Figure 3, a detailed block diagram illustrating the contents of the remote power source 52 is shown. Remote power source 52 is connected to an AC distribution circuit 82 which supplies AC current to the remote power source circuit. Rectifiers 84 convert the AC to a minus 48 volts DC. Converters 86 convert the minus 48 volts DC (VDC) to a minus 130 volts DC (VDC). Current limiters 88 limit the current to between 100 and 150 volt-amps. Connector block 92 distributes the appropriate supply power voltage and current to a plurality of twisted copper pairs 96. Multiple battery strings 94 supply back-up power at minus 48 volts DC to the converters 86 when an AC power outage occurs. Batteries strings 94 can power the telephony cards of the optical network units for at least eight hours.

With continued reference to Figure 3, an alarming system 98 is illustrated. Alarming system 98 provides electrical communication to key points in the remote power source circuit. Information pertaining to the RPS's 52 operation is relayed to the telephone company's central office 20. Key points in the remote power source circuit which are monitored include but are not limited to, the AC power source, the rectifiers 84 voltage, the converters 86 voltage, and current limiters 88 current. Alarming may be simple contact closures or a more sophisticated power monitor reporting over a secure protocol, such as a TCP-IP and a RS-485 link. With the information supplied by the alarming scheme 98, the central office 20 is able to determine whether the RPS 52 requires maintenance.

In an alternative embodiment as shown in Figure 4, a fiber to the neighborhood power configuration is illustrated. In the fiber to the neighborhood configuration 70, the optical network unit includes a digital subscriber line access multiplexer (DSLAM) 102 and a serving area interface (SAI) 104 which are capable of supporting approximately sixty-four to one hundred and twenty-eight video or data subscribers or customers and approximately three hundred to five hundred telephony customers. The DSLAM 102 converts digital light bits received from the fiber optic cable 34 to digital electrical bits and supplies the digital information to the customer 26. Essentially, the SAI 104 is a cross connect box which allows the telephone

company to piggyback the video and data signals from the DSLAM onto the copper drop 38 to provide additional services to the customer location 26. The DSLAM 102 and SAI 104 are co-located and are typically placed at a distance greater than nine thousand feet from the central office 20. In the fiber to the neighborhood configuration 70, the DSLAM 102 and SAI units 104 are within four thousand feet of the customer residence 26. A minimum of thirteen to twenty-six megabit per second bandwidth is achievable with a copper drop 38 of no more than four thousand feet. The DSLAM 102 is AC powered by the AC power fed 21 and contains batteries for providing a backup supply voltage to the telephone 30 when the AC power fails. The supply voltage is transmitted from the DSLAM 102 to the SAI 104 and then onto the copper drop 38 to the NID unit 24 and finally to the customer telephone 30. This configuration ensures that lifeline telephony is provided to the customer 26 at all times including power outages.

In an alternative embodiment, a fiber to the neighborhood 80 power architecture is illustrated in Figure 5. In this configuration, the optical network unit 22 is comprised of the DSLAM 102 and the SAI 104 and is typically located more than nine thousand feet from the central office 20 but within four thousand feet of the customer 26. A remote power source (RPS) 52 supplies the DSLAM 102 with a supply voltage (of minus 130 VDC) to operate and contains batteries to supply the DSLAM 102 with backup power when an AC power interruption or outage occurs. The DSLAM 102 and SAI 104 are located less than six thousand feet from the RPS 52. The RPS 52 can supply power to multiple DSLAM units, thus centralizing supply power and backup power at the RPS 52. This powering scheme decreases the number of power source sites requiring maintenance.

Now referring to Figure 6, an alternative embodiment for a fiber to the neighborhood power architecture 90 is illustrated. In a preferred embodiment, the optical network unit 22 includes a DSLAM 102 and is located in the central office 20. The copper drop 38 carries the communication data to the customer 26 who is within four thousand feet of the central office 20. The bandwidth for the copper drop 38, if less than four thousand feet, is a minimum of 13 megabits per second downstream and 3 megabits per second upstream. However, if the copper

drop 38 is less than three thousand feet the bandwidth is at least 26 megabits per second downstream and 3 megabits per second upstream. Lifeline telephony is supported through a battery backup power source (not shown) similar to the RPS 52 located in the central office 20.

5 Referring now to Figure 7, an alternative embodiment of a fiber optic network powering architecture 100 is illustrated, according to the present invention. In a preferred embodiment, the optical network unit 22 consists of a DSLAM 102 and a SAI unit 104. The DSLAM and SAI are located between four and six thousand feet from the central office 20 and less than four thousand feet from the
10 customer 26. Having a copper drop 38 of less than four thousand feet provides a bandwidth of at least 13 megabits per second to the network interface device 24. In operation, when a power outage occurs, the AC power feed to the DSLAM 102 is non-existent and backup power is fed from central office 20 through the twisted copper pair 36 to the SAI unit 104 and then to the customer telephone 30.
15 Alternatively, or when the twisted copper pair 36 is not present (i.e., in a new construction area), lifeline telephony is supported by a battery backup power source located within the DSLAM. When an AC power outage occurs the DSLAM batteries (not shown) will supply DC power to the DSLAM and to the customer telephone 30 via twisted copper pair 38.

20 Referring now to Figure 8, an alternative embodiment of the present invention illustrating a fiber to the neighborhood powering architecture 200 is shown. In a preferred embodiment, DSLAM 102 is located more than fifteen thousand feet from the central office 20 and within four thousand feet of the customer 26. The
25 optical network unit 22 includes a digital loop carrier (DLC) 106 which transfers the communication data from the central office 20 to the DSLAM unit 102. The DLC unit 106 is AC power fed from the power company and contains batteries for supplying backup power to the DSLAM. During a power interruption or failure, the DLC 106 and the DSLAM unit 102 are powered from the DLC backup battery
30 power source (not shown), which in turn power the customer telephone 30 using the copper drop 38, thereby achieving lifeline telephony.

Referring now to Figure 9, an alternate embodiment of a fiber to the neighborhood power architecture 300, according to the present invention is illustrated. An optical network unit 22 having a DSLAM 102 and a SAI 104 is located less than six thousand feet from the DLC 106 and is less than four thousand feet from customer 26. The DLC however, is greater than eighteen thousand feet from the central office 20. The DLC is AC power fed by the power company and contains batteries to supply backup power to the telephony copper drops 38 when an AC power interruption occurs. Batteries contained in the DLC 106 supply backup power (- 48VDC) to the DSLAM 102 which will power the customer telephones 30 using the copper drop 38 insuring lifeline telephony during AC power interruptions.

In still another embodiment of the present invention, a fiber to the neighborhood power architecture 400 is illustrated in Figure 10. In the present configuration, DSLAM 102 is greater than six thousand feet from the DLC 106 and within four thousand feet of the customer 26. The DLC unit 106 however, is greater than fifteen thousand feet from the central office 20 and is AC power fed by the power company. An RPS unit 52 supplies backup power over a twisted copper pair 39 to the DSLAM 102 and is located within six thousand feet of the DSLAM. Once the backup power is supplied to the DSLAM 102, the telephone 30 receive power from the DSLAM over the twisted copper pairs 38.

Now with reference to Figure 11, an alarm system 500 for monitoring the remote power system 52 is illustrated. A plurality of twisted copper pairs 110 run between the optical network unit 22 and the RPS unit 52. The twisted copper pairs 110 transport binary alarms, plus there may be one pair for dial-up access to a power monitor (not shown). In operation, alarm system 500 enables the central office to use the fiber optic cable 36 to monitor the power level and other operational parameters of the RPS 52 (as further shown in Figure 3 and described previously). Alternatively, the alarm power system 500 can use an RS 485 circuit (or similar circuit) which can transmit data to the optical network unit 22 using a secure two-way protocol such as an X.25 or a TCP/IP.

With reference to Figure 12, a flow chart illustrates the method of the present invention. More specifically, at block 600 the communication data is converted from an optical state to an electrical state. At block 602 the communication data is transferred from the telephone company's central office (CO) to the optical network unit. At block 604 a supply voltage is transmitted to the ONU from a power source which may be located remote form the DSLAM or proximate to the DSLAM, DCL, or the CO. The power source is capable of supplying backup power to the ONU when an AC power interruption occurs. Finally, at block 606 the supply voltage and the communication data are conducted along a copper drop to establish telephone communication with a customer telephone to ensure lifeline telephony during AC power interruptions.

While embodiments of the invention have been illustrated and described, it is not intended that these embodiments illustrate and describe all possible forms of the invention. The words used in the specification are words of description rather than limitation, and various changes may be made without departing from the spirit and scope of the invention.

WHAT IS CLAIMED IS:

- 1 1. A system for powering a fiber optic communication network
2 which transmits communication data between a telephone company central office and
3 a remote user device, the system comprising:
4 a digital subscriber line access multiplexer for converting the
5 communication data from a digital optical state to a digital electrical state;
6 a fiber optic communication medium configured to transfer the
7 communication data between the telephone central office and the digital subscriber
8 line access multiplexer;
9 a power source configured to supply an electrical supply voltage to
10 power the digital subscriber line access multiplexer, the power source having an AC
11 power feed for providing power to the digital subscriber line access multiplexer and
12 a DC power feed for providing power to the digital subscriber line access multiplexer
13 when the AC power feed is not supplying power to the digital subscriber line access
14 multiplexer; and
15 an electrical conducting medium configured to conduct the electrical
16 supply voltage and the communication data from the digital subscriber line access
17 multiplexer to a network interface device in electrical communication with the
18 remote user device.
19
20 2. The system of claim 1, further comprising a serving area
21 interface configured to provide an access point to connect a plurality of
22 communication signals from the digital subscriber line access multiplexer to the
23 electrical conducting medium.
24
25 3. The system of claim 1, further comprising a digital loop carrier
26 for providing a plurality of digital communication data to the digital subscriber line
27 access multiplexer.
28
29 4. The system of claim 1, wherein the power source is located
proximate to the digital subscriber line access multiplexer.

30 5. The system of claim 1, wherein the power source is remote
31 from the digital subscriber line access multiplexer and supplies power to a plurality
32 of digital subscriber line access multiplexers.

33 6. The system of claim 1, wherein the power source is located
34 proximate to the telephone company central office.

1 7. The system of claim 1, wherein the power source is located
2 proximate to a digital loop carrier.

3 8. The system of claim 1, wherein the remote user device is a
4 telephone.

5 9. The system of claim 1, wherein the remote user device is a
6 computer.

7 10. The system of claim 1, wherein the remote user device is a
8 television.

9
10 11. The system of claim 1, wherein the power source comprises a
11 plurality of rectifiers, a plurality of converters, a plurality of current limiters, and
12 a plurality of batteries configured to supply DC voltage to the digital subscriber
13 line access multiplexer.

14 12. The system of claim 1, wherein the power source comprises
15 an alarm system configured to monitor the operation of the power source and relay
16 operation information to the telephone company central office.

17 13. The system of claim 9, further comprising a plurality of
18 conducting mediums configured to connect the alarm system in the power source to
19 the digital subscriber line access multiplexer for relaying power source operation
20 information to the telephone company central office.

21

22 14. A method for powering a fiber optic communication network
 23 which transmits communication data between a telephone company central office and
 24 a user device, the method comprising:
 25 converting communication data from an optical state to an electrical
 26 state using a digital subscriber line access multiplexer;
 27 transferring the communication data between the telephone central
 28 office and the digital subscriber line access multiplexer;
 29 transmitting an electrical supply voltage from a power source
 30 configured to supply an electrical supply voltage to power the digital subscriber line
 31 access multiplexer, the power source having an AC power feed for providing power
 32 to the digital subscriber line access multiplexer and a DC power feed for providing
 33 power to the digital subscriber line access multiplexer when the AC power feed is
 34 not supplying power to the digital subscriber line access multiplexer to the digital
 35 subscriber line access multiplexer; and
 36 conducting the electrical supply voltage and the communication data
 37 from the digital subscriber line access multiplexer to a network interface device in
 38 electrical communication with the remote user device.
 39

ABSTRACT OF THE DISCLOSURE

A system and method of powering a fiber optic communication network are provided which transmits communication data between a telephone company central office and remote user device. The system includes a power source configured to provide an electrical supply voltage to a digital subscriber line access multiplexer. The power source having an AC power feed for providing power to the digital subscriber line access multiplexer and a DC power feed for providing power to the digital subscriber line access multiplexer when the AC power feed is not supplying power. Further, an electrical conducting medium configured to conduct the electrical supply voltage and the communication data from the digital subscriber line access multiplexer to the remote user device is provided. Therefore, the present invention provides a system and method for reliably powering a fiber optic communication network with AC power under normal operating conditions and DC backup power when the AC power is interrupted, thus providing lifeline telephony service while, reducing maintenance costs by having a limited number of centralized remote power sites.

Fig. 1

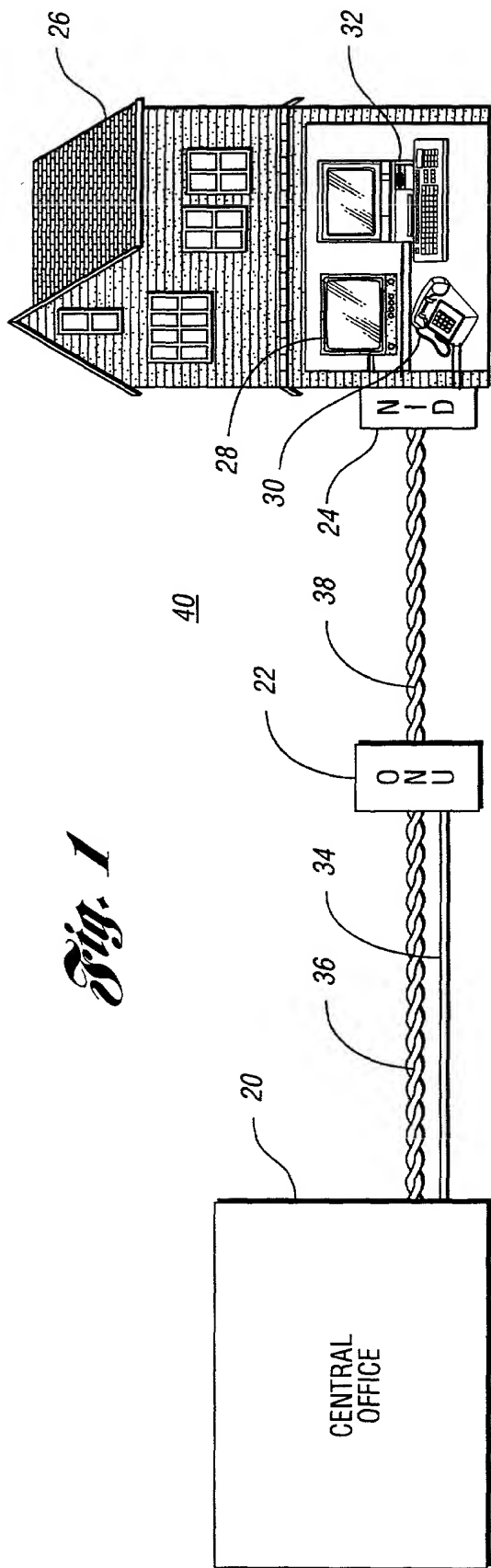


Fig. 2

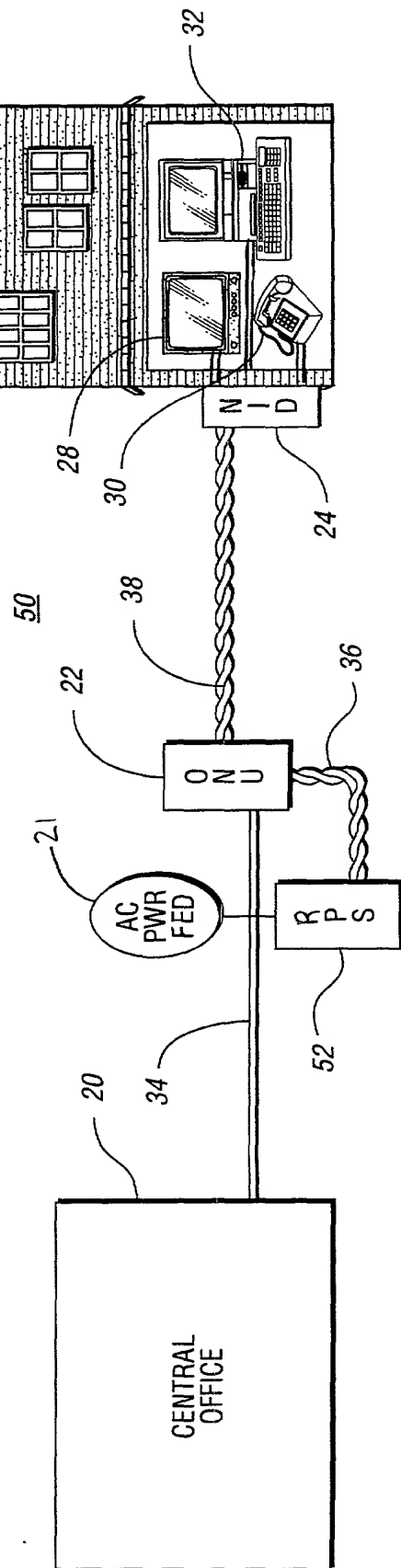


Fig. 3

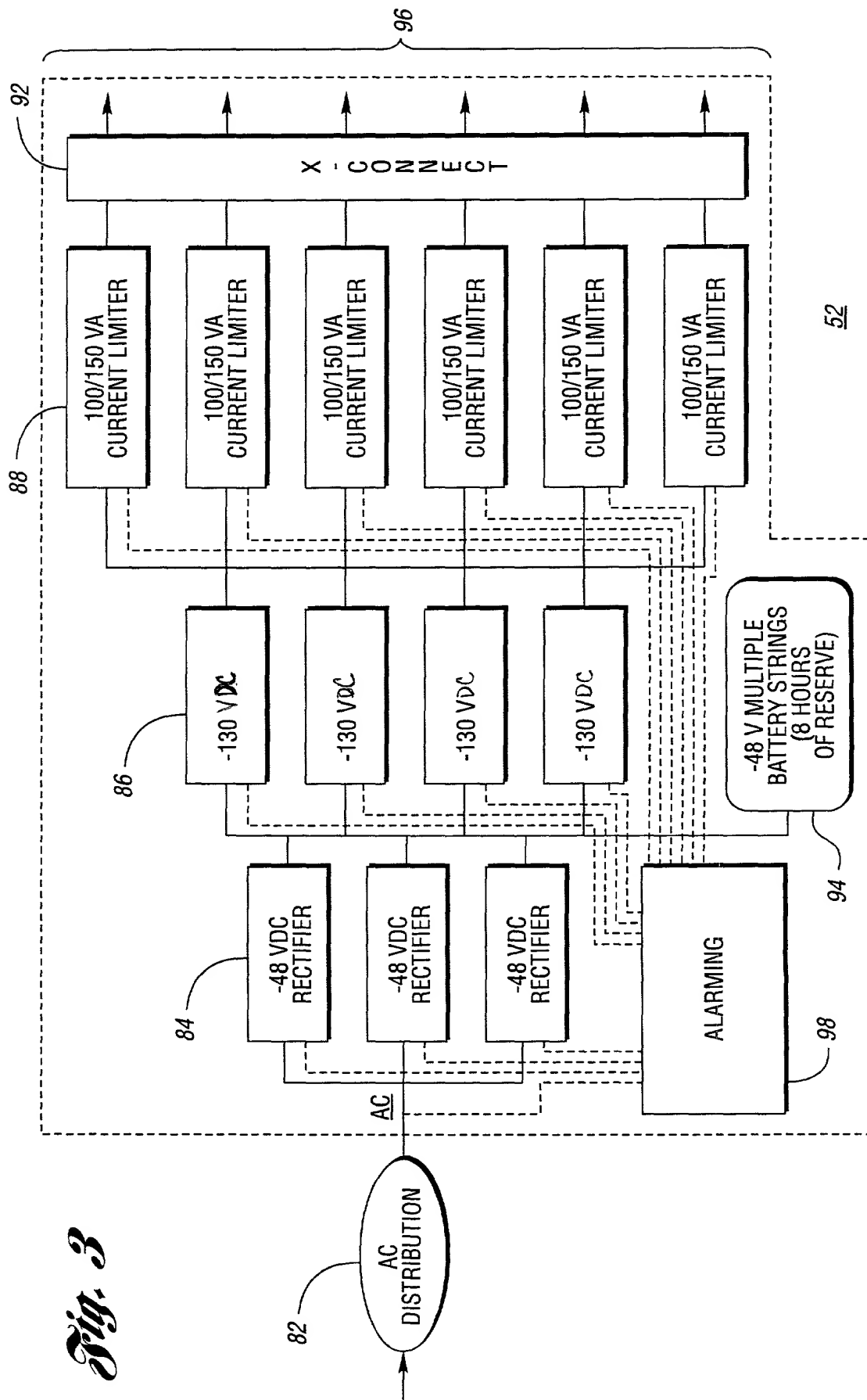


Fig. 4

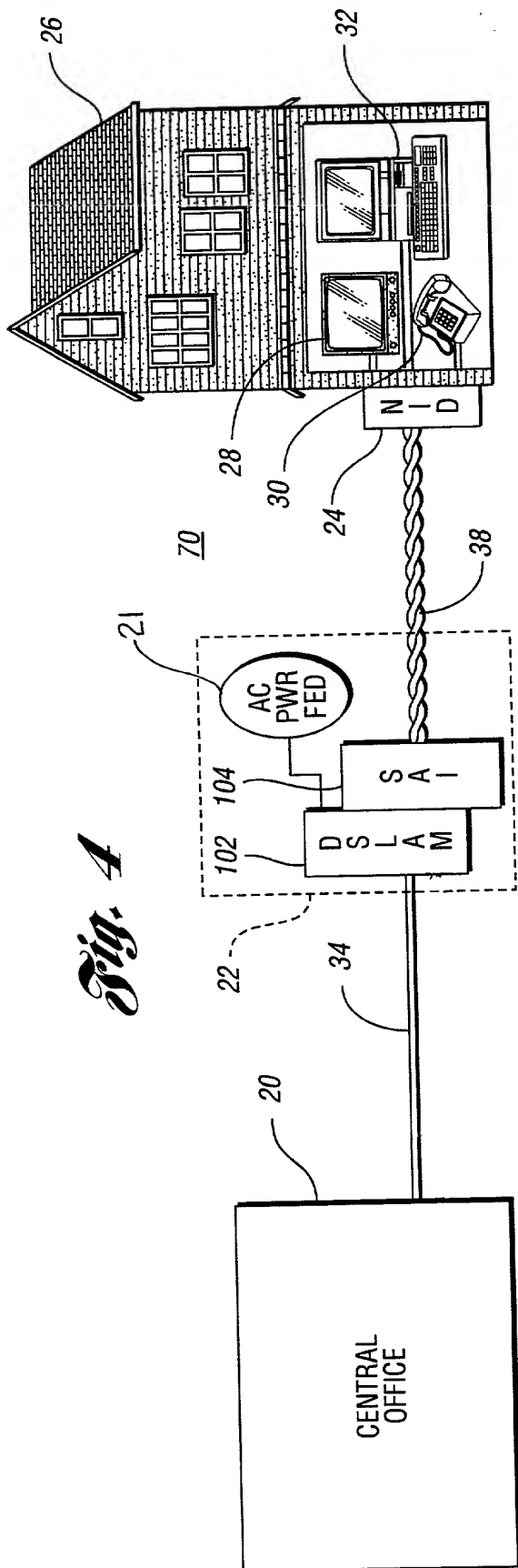


Fig. 5

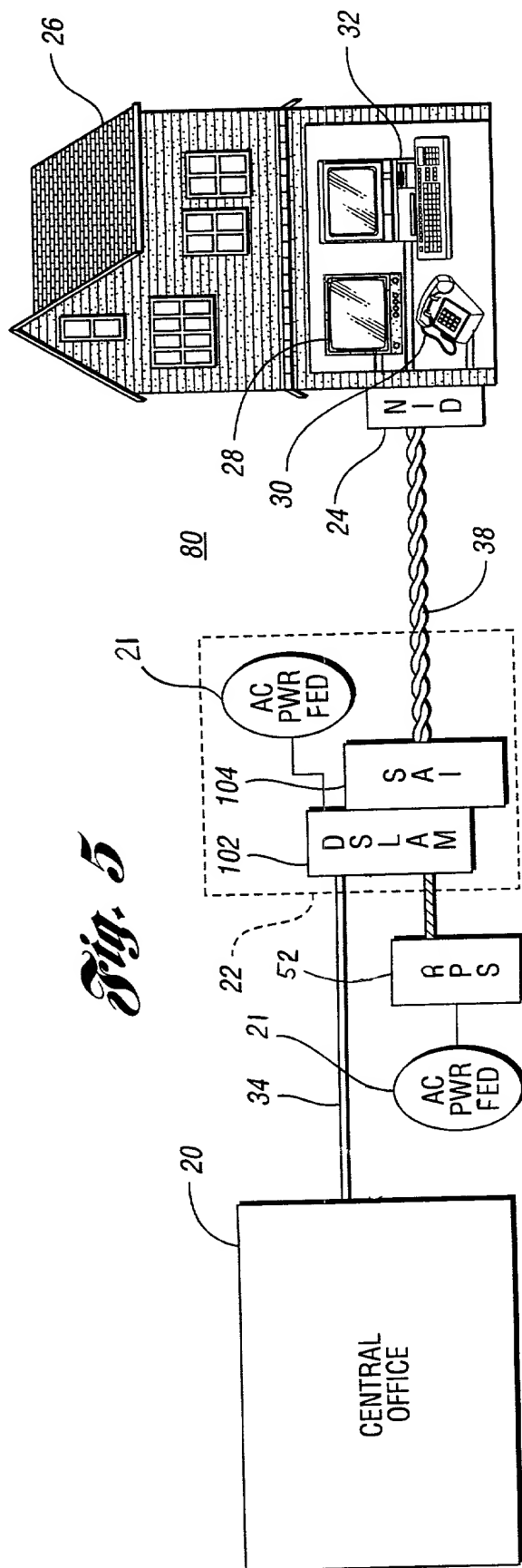


Fig. 6

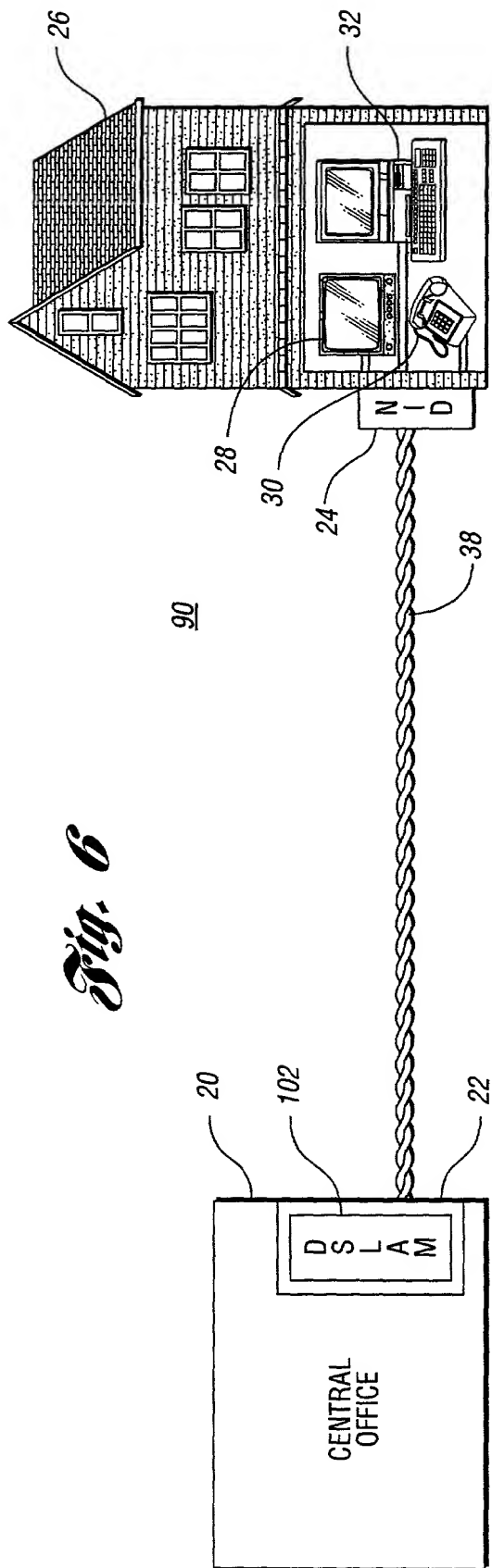
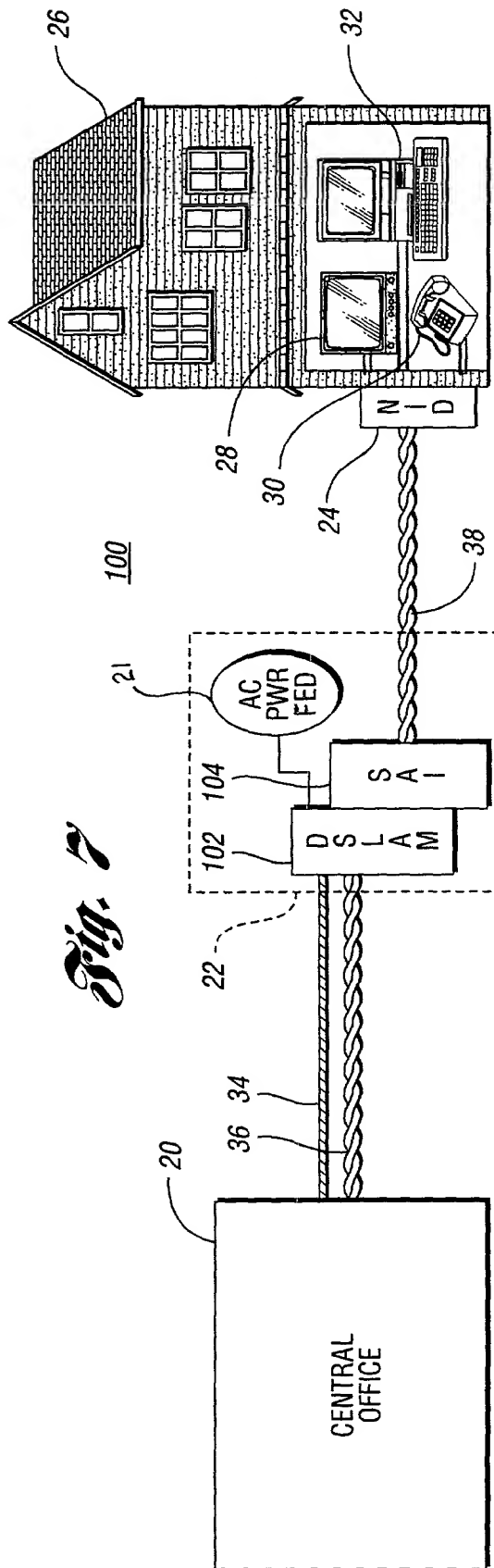


Fig. 7



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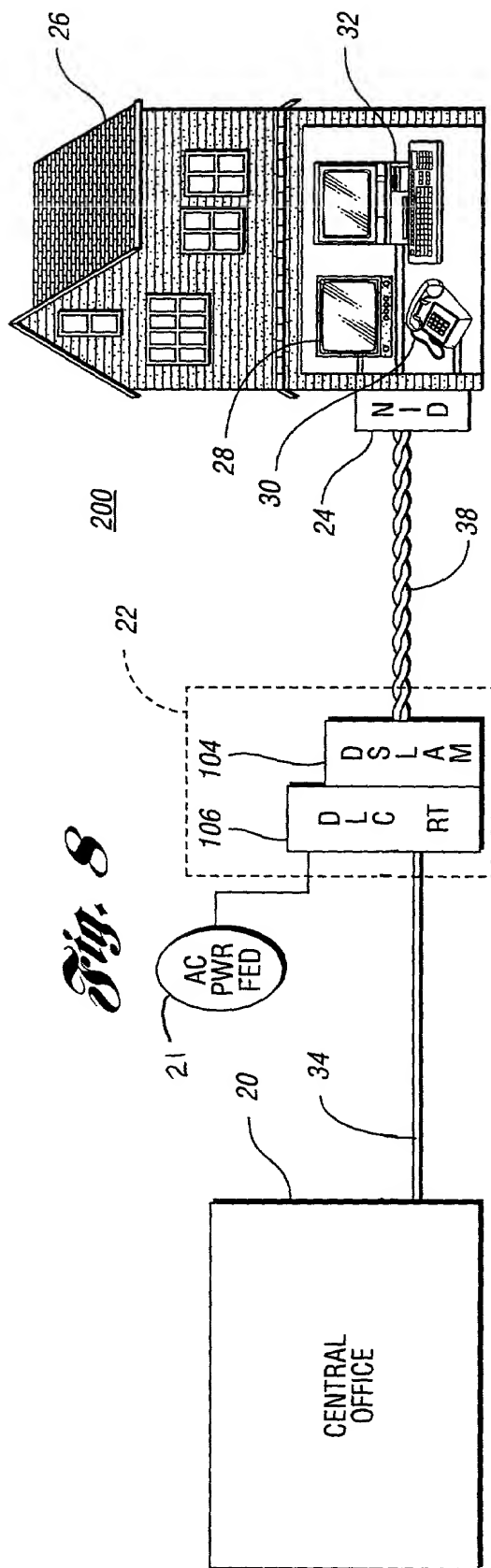


Fig. 6

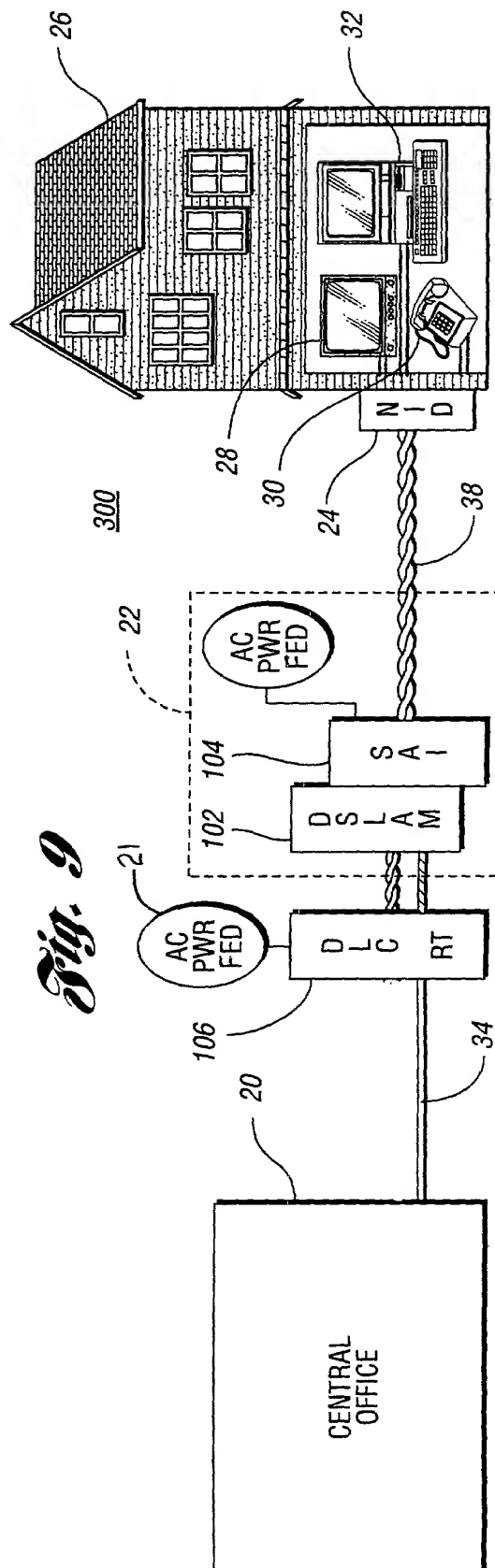
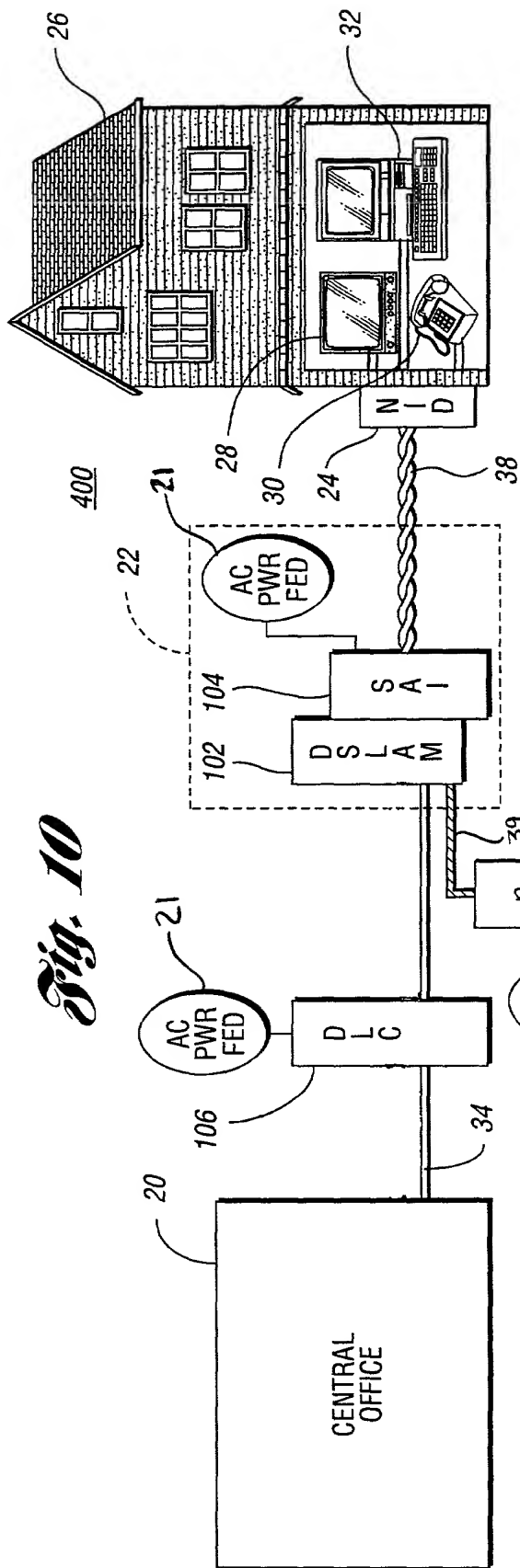
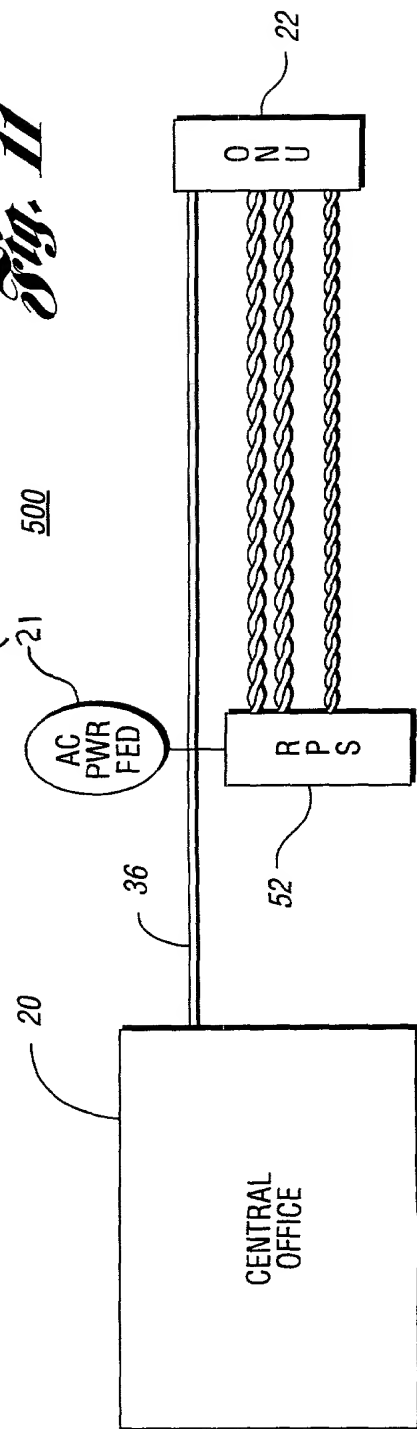


Fig. 10

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graph TD; 600[CONVERT DATA FROM OPTICAL TO ELECTRICAL] --> 602[TRANSFER DATA FROM CENTRAL OFFICE TO NETWORK UNIT]; 602 --> 604[TRANSMIT SUPPLY VOLTAGE TO THE NETWORK UNIT]; 604 --> 606[CONDUCT SUPPLY VOLTAGE AND COMMUNICATION DATA TO USER DEVICE];
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600

CONVERT DATA FROM OPTICAL TO ELECTRICAL

602

TRANSFER DATA FROM CENTRAL OFFICE TO NETWORK UNIT

604

TRANSMIT SUPPLY VOLTAGE TO THE NETWORK UNIT

606

CONDUCT SUPPLY VOLTAGE AND COMMUNICATION DATA TO USER DEVICE

Fig. 12

DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY

Atty. Docket No. 1569/1570(USW 0471 PUS)

First Named Inventor Curtis L. Ashton

As a below named inventor, I hereby declare that my residence, post office address and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

FIBER TO THE CURB AND FIBER TO THE NEIGHBORHOOD POWER ARCHITECTURE,

the specification of which:

☒ is attached hereto; or
☐ was filed on (MM/DD/YYYY) _____ as U.S. Application Number or PCT International Application Number _____, and was amended on (MM/DD/YYYY) ____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below, and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

| <i>Prior Foreign Application Number(s)</i> | <i>Country</i> | <i>Foreign Priority Date (MM/DD/YYYY)</i> | <i>Priority Not Claimed</i> | <i>Certified Copy Attached? (Yes/No)</i> |
|--|----------------|---|-----------------------------|--|
| | | | | |
| | | | | |

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

| <i>Application Number(s)</i> | <i>Filing Date (MM/DD/YYYY)</i> |
|------------------------------|---------------------------------|
| | |
| | |

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code § 112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, § 1.56 which occurred between the filing date of the prior application and the national or PCT international filing date of this application.

| <i>Application Number(s)</i> | <i>Filing Date (MM/DD/YYYY)</i> | <i>Status: Patented, Pending, Abandoned</i> |
|------------------------------|---------------------------------|---|
| | | |
| | | |

Declaration for Patent Application (cont'd.)Atty. Docket No. 1569/1570 (USW 0471 PUS)

I hereby appoint the following registered practitioners to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Ernie L. Brooks, Reg. No. 26,260; James A. Kushman, Reg. No. 25,634; David R. Syrowik, Reg. No. 27,956; Mark A. Cantor, Reg. No. 30,614; Ralph M. Burton, Reg. No. 17,748; Robert C.J. Tuttle, Reg. No. 27,962; Earl J. LaFontaine, Reg. No. 30,766; Ronald M. Nabozny, Reg. No. 28,648; Thomas A. Lewry, Reg. No. 30,770; John E. Nemazi, Reg. No. 30,876; Kevin J. Heintz, Reg. No. 29,805; William G. Abbott, Reg. No. 31,936; Donald J. Harrington, Reg. No. 17,427; Paul M. Schwartz, Reg. No. 33,278; Timothy G. Newman, Reg. No. 34,228; Frederick M. Ritchie, Reg. No. 18,669; Robert C. Brandenburg, Reg. No. 29,048; A. Frank Duke, Reg. No. 20,937; John M. Halan, Reg. No. 35,534; Jeffrey M. Szuma, Reg. No. 35,700; James R. Ignatowski, Reg. No. 26,741; Frank A. Angileri, Reg. No. 36,733; William G. Conger, Reg. No. 31,209; Rhonda L. McCoy-Pfau, Reg. No. 37,887; Sangeeta G. Shah, Reg. No. 38,614; Christopher W. Quinn, Reg. No. 38,274; Robert C. Jones, Reg. No. 35,209; David S. Bir, Reg. No. 38,383; Konstantine J. Diamond, Reg. No. 39,657; James N. Kallis, Reg. No. 41,102; Hugo A. Delevie, Reg. No. 32,688; Ralph E. Smith, Reg. No. 35,474; Michael S. Brodbine, Reg. No. 38,392; Jeremy J. Curcuri, Reg. No. 42,454; Mark D. Chuey, Reg. No. 42,415; and John J. Ignatowski, Reg. No. 36,555; Pete N. Kioussis, Reg. No. 41,117; Gigette M. Bejin, Reg. No. P-44,027; Stephanie M. Mansfield, Reg. No. P-43,773; Mark E. Stuenkel, Reg. No. P-44,364; Stephen F. Jewett, Reg. No. 27,565; Peter J. Kinsella, Reg. No. 39,729; Mark A. Thomas, Reg. No. 37,953..

Address all correspondence and telephone calls to Peter J. Kinsella
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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

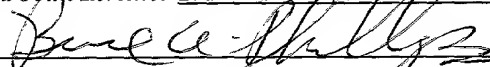
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Declaration for Patent Application (cont'd.)

Atty. Docket No. 1569/1570 (USW 0471 PUS)

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Citizenship

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Inventor's signature _____

Date _____

Post Office Address _____

Residence _____

Citizenship _____

Full Name of Seventh Joint Inventor _____

Inventor's signature _____

Date _____

Post Office Address _____

Residence _____

Citizenship _____

Full Name of Eighth Joint Inventor _____

Inventor's signature _____

Date _____

Post Office Address _____

Residence _____

Citizenship _____

Full Name of Ninth Joint Inventor _____

Inventor's signature _____

Date _____

Post Office Address _____

Residence _____

Citizenship _____